

Chapter 24

RK, RL, RM, RP disks

24.1 RP05 and RP06 disks

This section provided by Paul Lloyd with Pete Griffin . . .

24.1.1 PCB and head part numbers

Used On		Dec	Memorex	Part Description
05	06			
Y	Y	29-22067	013231	INPUT - D01 (J1 in for RP05, out on RP06)
Y	Y	29-22068	014501	OUTPUT - D02
Y	Y	29-22069	012861	PRECOMPENSATION - D03
Y	Y	29-22070	020236	INDEX - D04
Y	Y	29-22071	012856	VARIABLE FREQ. OSC. - D05
Y	Y	29-22072	012916	SEQUENCE - D10
Y	Y	29-22073	013891	SERVO CONTROL - D11
Y	Y	29-22077	011706	LINEAR AMP - D19
Y	Y	29-22078	014741	DETECTOR & SELECT - D19
Y	Y	29-22078-01 ¹	012431	DETECTOR & SELECT - D19
Y	Y	29-22079	014661	DATA SAFETY & HEAD SELECT - D20
Y	Y	29-22079-01 ¹	014661	DATA SAFETY & HEAD SELECT - D20
Y	Y	29-22100	012486	SERVO PRE-AMP
Y	*N*	29-22176	013086	RP05 VELOCITY SERVO - D14
Y	*N*	29-22234	013091	RP05 POSITION SERVO - D15
Y	*N*	29-22235	013096	RP05 WRITE LOGIC - D17
Y	*N*	29-22233	011901	RP05 READ/WRITE MATRIX
Y	*N*	29-22225	211535	RP05 A-DOWN HEAD ²
Y	*N*	29-22226	211536	RP05 A-UP HEAD ²
Y	*N*	29-22227	211537	RP05 B-DOWN HEAD ²
Y	*N*	29-22228	211538	RP05 B-UP HEAD ²
Y	*N*	29-22229	211539	RP05 SERVO HEAD ²
N	Y	29-22074	012476	RP06 VELOCITY SERVO - D14
N	Y	29-22075	012481	RP06 POSITION SERVO - D15

¹This is an OLD part number, no longer used

² RP05 heads have blue plugs

Used On				
05	06	Dec	Memorex	Part Description
N	Y	29-22076	012746	RP06 WRITE LOGIC - D17
N	Y	29-22099	012491	RP06 READ/WRITE MATRIX
N	Y	29-22104	217559	RP06 A-DOWN HEAD †
N	Y	29-22105	217558	RP06 A-UP HEAD †
N	Y	29-22106	217561	RP06 B-DOWN HEAD †
N	Y	29-22107	217560	RP06 B-UP HEAD †
N	Y	29-22108	217562	RP06 SERVO HEAD †

† RP06 heads have red plugs

24.1.2 Other useful part numbers

- 29-22086 Filter
- 12-11239 Lamps
- 29-22118 Rubber Washer (carriage backstop)
- 29-22786 Motor kit
- 29-22126 Belt
- 29-22143 Capacitor Bank
- The MEMOREX parts are no longer included in the IPB fiche. Keep the old red one if you need it.
- There is a COOKBOOK; it has lots of part numbers but no pictures, so it can be hard to identify a part.

24.1.3 Unsafe condition monitor points

There is OR gating which causes the UNSAFE light.

Condition A (-UNSAFE light) is caused by any of the Conditions A1 thru A9.

Condition A6 (+ABNORMAL STOP) is caused by any of the Conditions A6A thru A6F.

Condition A7 (DC WRITE UNSAFE) is caused by any of the Conditions A7A thru A7D.

Condition A8 (AC WRITE UNSAFE) is caused by A8A or A8B.

Condition A9 (HEADS UNSAFE) is caused by A9A or A9B.

A	D02L27	-UNSAFE	to front panel lamp.
A1	D02R05	+WRT&OFFSET/NOT RDY	to UNSAFE 'or' gate
A2	D02R06	+READ AND WRITE	to UNSAFE 'or' gate
A3	D02R21	+PLO UNSAFE	to UNSAFE 'or' gate
A4	D02L23	+35V REG FAIL LATCH	to UNSAFE 'or' gate
A5	D02R24	+WR AND NO FINE TRK	to UNSAFE 'or' gate
A6	D02R28	+ABNORMAL STOP	to UNSAFE 'or' gate
A6A	D10L33	+SERVO ERROR STOP	to ABNORMAL STOP 'or' gate
A6B	D10L34	+HDS RET SW ERR STOP	to ABNORMAL STOP 'or' gate
A6C	D10L35	+ER ACTIVE STOP	to ABNORMAL STOP 'or' gate
A6D	D10R35	+SERVO RETRACT STOP	to ABNORMAL STOP 'or' gate
A6E	D10L36	+UPSPEED ERROR STOP	to ABNORMAL STOP 'or' gate
A6F	D10R38	+ER LOSS STOP	to ABNORMAL STOP 'or' gate
A7	†	DC WRITE UNSAFE	to UNSAFE 'or' gate
A7A	D02L05	+WRITE FAIL	to DC WRITE UNSAFE 'or' gate

† Not on backplane

	A7B	D02R09	+SINK UNSAFE	to DC WRITE UNSAFE 'or' gate
	A7C	D02L12	+MULTI WRITE	to DC WRITE UNSAFE 'or' gate
	A7D	D02R13	+SUBT FAIL LATCH	to DC WRITE UNSAFE 'or' gate
A8		↑	AC WRITE UNSAFE	to UNSAFE 'or' gate
	A8A	D02L10	+AC WRITE UNSAFE	to AC WRITE UNSAFE 'or' gate
	A8B	D02L14	+AC SS FAIL	to AC WRITE UNSAFE 'or' gate
A9		↑	HEADS UNSAFE	to UNSAFE 'or' gate
	A9A	D02L16	+NO HEAD SELECT	to HEADS UNSAFE 'or' gate
	A9B	D02L29	+MULTI HEAD SEL	to HEADS UNSAFE 'or' gate

↑ Not on backplane

24.1.4 Troubleshooting notes for beginners.

There is a white push-button on the lower edge of the control panel to do a lamp test. Find out which work and which are blown before you proceed.

LAP refers to the Logical Address Plug which is the removable unit number.

DCL is the Drive Control Logic, the DEC made controller on the side of the RP06.

There is a cookbook knocking around called **RP05/RP06 FIELD HANDBOOK**

24.1.4.1 Drive will not spin up, no START lamp.

Check the UNSAFE lamp; if it is ON, go thru the ABNORMAL STOP and UNSAFE monitor points.

If UNSAFE is off, there is probably a Sequence or PSU problem.

To stop overloading the mains, a device is employed to ensure that only one drive can be spinning up at once, also the drive has the capability to be spun up/down remotely, this is called *sequencing*. On our drives a *sequence cable* runs between the drives, it comes in on J12 and goes out on J13.

To START, the drive must see a HIGH on J12-pin2 and a LOW on J12-pin3.

On the first drive J12-Pin3 gets its LOW by a jumper plug connecting J12-pin3 to J12-pin4, this is the top 2 pins of the higher socket. This LOW will then get propagated by each drive to the next one (even when powered off) as long as the drive is not spinning up. Pin2, on the other hand, will be HI as long as no drive in the string is currently spinning up.

The PSUs are monitored for good output, if any are bad you get a CLEAR signal which prevents the logic working when you press START.

If you look at D04-R29 and see zero volts, you have a solid CLEAR signal, checkout the PSUs with a scope (the normal failure mode is "ripple").

24.1.4.2 Drive will not spin up; START lamp, but no DOOR LOCKED lamp.

This is the most common fault, either the door is not slid shut properly and the solenoid can't activate OR (more often) the 'COVER PRESENT' microswitch is stuck. However the same symptom is caused by a duff PSU. On these drives the favoured PSU failure mode is blown diodes or capacitors on the unregulated power rails, this causes bad ripple on the regulated rails - always use a scope around these drives, a DVM can be very mis-leading.

24.1.4.3 Drive will not spin up; START and DOOR LOCKED and UNSAFE lamps.

The drive should come up to speed in about 20 seconds, the detector is a microswitch operated by the 'comb' guarding the heads. This in turn is rotated out into the pack by the wind! If it does not get up to speed in 20 seconds it will spin down with an 'unsafe'. If the belt is busted, the motor goes but the pack doesn't. Notice that the brake causes the motor to get hot, and repeated spinning down commonly causes the heat sensor in the motor to cut out and stop it spinning up, just leave it to cool while you have a coffee; if you're doing a lot of work in this area use the breaker and let the motor run down gradually without the brake. The motor could be duff, the centrifugal switch can affect the start winding, this shows as "juddering" attempts to start (in either direction!) or works o/k after a good whack.

24.1.4.4 Drive spins up; but heads do not load, and UNSAFE lamp.

Remove the LAP plug, this will inhibit the heads from attempting a load.

- If the UNSAFE condition goes away, you maybe have a "head load" problem. Do the heads load manually? To try this; spin the pack up, remove the LAP, push the head tower forward. A common problem on older drives is the heads held back by the back stop (a rubber washer) deteriorating to the consistency of blu-tack. The back-stop is removed by pushing the carriage forward (with power off and no pack installed) about an inch (to the point that they would come off the runners and land on the pack) and then unscrewing the tachometer rod from the back of the head tower. Maybe there is an electronic problem moving the linear motor.
- If the UNSAFE condition persists, you maybe have an up-to-speed problem. The "comb" should be pushed onto the micro switch by the rush of air. If not, it is probably the centrifugal switch in the motor not calling the run winding, more impact engineering could verify it. Check the cabling to the micro-switch, it can get pinched between the chassis and the shroud.
- You may eventually need a scope to look at the inputs to the UNSAFE logic.

24.1.4.5 Drive spins up; but heads do not load (no READY) and no UNSAFE lamp.

The most common cause of this is the DCL tripped out, the 'A' should be illuminated next to 'CONTROL' to show the DCL is not tripped out. The drive needs a signal called 'controlled ground' which comes from a small power monitor on the floor in the DCL area containing a relay that must be called in by the +5 and +15v power supplies. The LAP must also be in.

24.1.4.6 Non-existent drive

This is a bit set in the RH controller when there is no response from the selected drive, it will normally also be accompanied by Massbus Control Parity Error (on an RH11/70 this led flashes when software does an autosize). The LAP gives the drive number and this must obviously be in. The output of the LAP is compared with the massbus lines DRV SEL within the DCL logic, but a pre-requisite of receiving DRV SEL from the massbus is POWER OK. POWER OK comes from the same small power monitor in the DCL area which supplied the ground signal to allow the heads to load. Also note that -15 volts could be missing (check AB2 on a massbus transceiver) and you will still get POWER OK!

24.1.4.7 Data Checks and Write Checks

We all know what a DCK is, but there is an old chestnut on RH780's (which is where you will mainly see RP's) where a data-check during a 'write check function' causes an operation abort with WCK set instead of DCK.

The 'first pass' for DCK's is . . .

- Check spindle ground for good contact.
- Check absolute filter is less than a year old.
- Check absolute filter is not pushing against the front door due to broken retaining clips.
- Check the flexible strip which grounds the carriage is not busted.
- Check that the earth wire from the motor has not pulled out of its crimp at the control box end.
- Clean the heads *in situ* , being very careful; do not do this if things have a tendency to fall apart in your hands!
- There have been SEVERAL, WELL-INFORMED inputs lately that the heads on a RP06 get a build up of dirt which necessitates REMOVAL and CLEANING of ALL heads once the DCK rate starts rising.

24.1.5 Glass lds

There was a batch which were made too wide, the glued on runners snap off during fitting, just keep ordering until they get it right?

24.1.6 Rubber Backstops

These can be 'hard' or 'soft' rubber, the 'hard' ones can be difficult to fit and may pop off after a day or two. Spit on it to ensure it seats properly.

24.1.7 Filter

'CAMFIL' filters may have hose connections which break away easily or holes in the glued joint - check before use.

24.1.8 Motor replacement.

Sometimes the motor needs replacing (common symptoms are 'juddering', turning slowly, spinning down just before gets up to speed).

A good tip is to use a scissor jack from your car to support the motor during replacement.

You have to remove the power supply from the rear, copy down the connections.

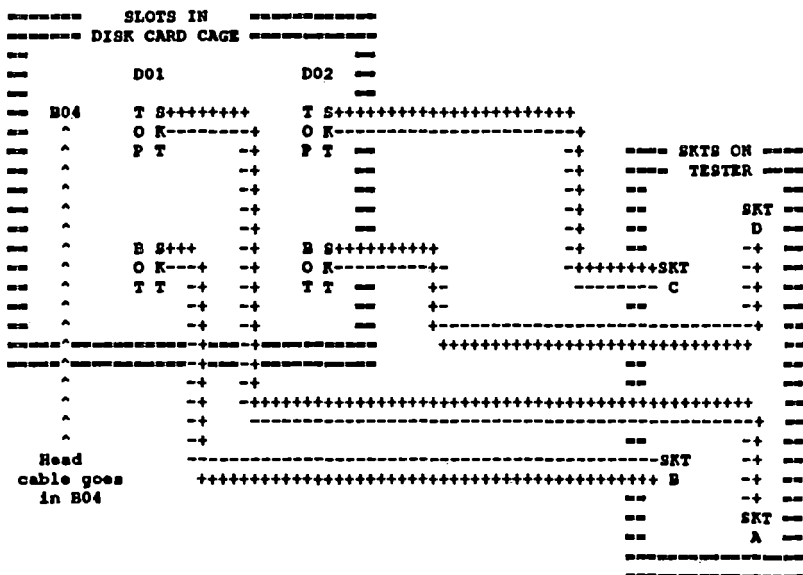
Some motor mounting screws are lock-tighted in, they snap off when you try to remove them, this reveals a bush in the base casting which then has to be replaced using a very large socket. If you got a 'motor replacement kit' (29-22786) from logistics there are new bushes and mounting screws provided. If you just got the motor then you keep trying till you get a 'kit'.

The belt adjustment screw should have 7 threads protruding at the rear of the drive.

24.1.9 Connecting the PERCH tester.

Switch off the drive using CB100 (front, bottom, left of drive), it is safest to disable the massbus transceivers first. The four cables from the tester connect into the pairs of connectors on the boards in position D01 and D02 of the drive, after removing the cables to the DCL. The tester sometimes has a loopback connector supplied for self-test. The proper manual talks about the cables but it is all very confusing, the sockets/plugs are talked of as A,B,C,D, these are the sockets on the tester.

The following figure is to show that A&B go to D01, C&D go to D02. The confusion is which way up they go, so I've identified the cable edges with + and - signs. However the good news is that any combination does NOT blow it up!



Once you've got it cabled up, switch on the tester and then the drive.

Do a **RESET** on the tester, press **START** on the drive, and then another **RESET** on the tester. **START** and **DOOR LOCKED** should come on.

Now it's spinning, the heads will not load until you issue a command, you could remove the LAP and do a manual load onto a scratch pack if you wanted.

24.1.10 Checking Head Alignment.

The CE pack must be acclimatised to the computer room.

Connect the tester and spin up the CE pack as described above, except set WRITE PROTECT on the drive.

In the following steps sometimes you have to press **EXECUTE** twice so that the current routine stops, then the new routine is loaded.

- 1. Set FUNCTION=1, DATA=03, press EXECUTE.**

2. Set FUNCTION=0, DATA=0, press EXECUTE.
3. Let the drive do a random seek for 15 minutes.
4. Set FUNCTION=1, DATA=5, press EXECUTE.
5. Set FUNCTION=0, DATA=0, press EXECUTE. The heads go over the alignment cylinder.
6. Leave for 5 minutes.
7. The meter should be on FINE (x1 NOT x5). Take the reading for Head 0.
8. Set FUNCTION=6 and press EXECUTE to advance to the next head and take the reading, do this for all 19 heads. Record all the readings (eg +75,-120) so you can see how much a head needs adjusting and in which direction, note that you have to guess at red zone figures.
It is VERY IMPORTANT that you strictly follow the same procedure, readings after 2 minutes are not the same as 5 minutes.
9. If a head is not in the red zone, leave it alone.

24.1.11 Adjusting a head

There are two reasons to adjust a head. Either you've just put a new one in so you do an initial adjustment or you've checked the alignment and decided that the head needs adjusting.

If going from a complete rebuild, the servo head should be pushed right back, however there is a rumour that some heads cannot be adjusted unless the servo head is pushed forward slightly. Check that each head can be swung either side of its target point on the meter before getting serious.

1. Get the heads over the alignment cylinder and select an individual head as explained in Section 24.1.10.
2. Draw back the tunnel and leave for 5 minutes to stabilize.
3. Loosen the head front screw, put it to initial torque (2 clicks).
4. Loosen the head rear screw, put it to initial torque (2 clicks).
5. On initial set-up adjust the head to the reading in Table 24-1

Table 24-1: RP05/6 Head Alignment

	Head Number		
	0 to 2	3 to 13	14 to 18
RP06	+RED ZONE	+60	-20
RP05	-60	-60	-60

6. If adjusting an individual head, move it the required distance (eg if the reading was +250 when you checked it, you must now set the reading 250 to the left of the current reading).
7. Tighten the front then rear head screws to final torque (2 clicks).
8. Close the tunnel and go to the 'checking alignment' procedure, Section 24.1.10.

24.1.12 Tacho gain

1. Set FUNCTION=1, DATA=4, press EXECUTE.
2. Set FUNCTION=5, DATA=1, press EXECUTE.
3. Set FUNCTION=0, DATA=0, press EXECUTE.
4. On an RP05 adjust VSER so tester lamps 0&1 alternate.
5. On an RP06 adjust VSER so tester lamps 0 is on, 7 is flashing.

24.1.13 INDEX PULSE to DATA measurement causing FORMAT and HEADER errors.

Heads which are out of tolerance in the 'lateral' plane may give FORMAT ERRORS, HEADER CRCs etc. These are fixed by re-formatting the pack, but re-appear once the pack is moved to another drive. A batch of suspect heads were once shipped to the field - they had TDC stamped on the shaft.

To check this:-

1. Scope trigger on D04R19 (INDEX) and look at D19R20.
2. Set FUNCTION=1, DATA=05, press EXECUTE.
3. Set FUNCTION=2, DATA=00, press EXECUTE.
4. Set FUNCTION=2, DATA=18, press EXECUTE.
5. Set FUNCTION=0, DATA=01, press EXECUTE.
6. The heads should go to cylinder 18 and read head 0.
7. You should see a high level burst between 105-118 usecs after INDEX.
8. Set FUNCTION=6, DATA=00, press EXECUTE to go thru heads.

24.2 RP07

To work on an RP07 you will need the Pocket Service Guide and the Pathfinder, both of these are kept in the Kit and on Fiche.

The green fiche gives all the FCOs and Tech-Tips, here is a condensed version . . .

- TT1 The RH780 must have M8276 at CS-E and M8277 at CS-H.
- TT5 First RP07 needs BC06Z-YA shielded massbus cable.
- TT10 Fluctuating blower pressure causes data errors.
- TT14 Check Rectifier/capacitor for bad connections.
- TT16 If changing a HDA replace the absolute filter - see TT24.
- TT17 Module revisions.
- TT22 Single-phase and 3-Phase blowers.
- TT24 New filter kit (29-26404-00) with better filter, hoses etc. Now it is only necessary to replace the absolute filter when replacing the HDA.
New abs-filter part number 29-23334.
New pre-filter part number 29-27278.
New air flow sensors may be required to prevent Air Flow Fault (error code 40 or 41) caused by new filters, part number is 29-24790-00.
- TT25 In the RH780 an M8274 replaces the M8277 to get a super-silo.
- TT36 A9/A10 must be matched
 if A9=100, A10=100 or 200
 if A9=101, A10=201
 if A9=200, A10=300
- TT39 Error codes 09-93 on spin-up.
- TT40 Late style HDAs do not have a key on the flexi-cable, if this is inserted into the backplane slot incorrectly it will blow the HDA on-board logic and cause Fault Code F6.
- TT41 More information about TT40

The late style HDAs (revision 102 as opposed to revision 2) need a late style A16 module. To make a A16 into the late style apply FCO RP07-I-041. See DEC-STUFF MAR'89 about errors in the FCO documentation!

The new A16 module should be a B9706402-105 or B9706632-02.

UNSAFE error codes 42, 43, 45, 1C, 3E, 3F, 80 can be caused by a flakey 3-phase detector (29-23605), this is not in pathfinder!

Notice the motor shuddering on spin-up.

UNISYS HDAs seem to be being delivered in a different format.

They work, but a READALL is slow. Also diagnostic cylinders 630/631 are unusable.

So first do a FMTRP07 to fix the customer area, then SET EVENT 18 to make it prompt for addresses and FORMAT cylinders 630 and 631.

24.3 RK06/7 useful information

24.3.1 RK06/7 Head in error determination

Determining the head in error from diagnostic printouts for RK06/7 is not as straight forward as one might think because both the PDP and VAX diagnostics can be misleading.

24.3.1.1 PDP11 Diagnostic ZR6P

From a ZR6P error printout there are three possible sources of the failing head, only one of which is reliably correct. The only reliable way is to look at the contents of MESSAGE LINE B3, the forth octal digit (going right to left) in this is the head at time of error. This digit decodes as follows ...

```
1 = Head 0
2 = Head 1      i.e A message line B3 contents of 004303
4 = Head 2      would be Head 2 in error.
                  ^
                  |
                  |
                  4 = Head 2
```

An Example ...

```
DRIVE NUMBER 2
DRIVE SERIAL NO. 397
PACK SERIAL NUMBER 00000063604
TIME:000:03:02
DATA CHK
RKCS1  RKCS2  RKWCR  RKBA  RKDA  RKDC  RKASOF  RKER
102320 000102 176430 107610 001004 001044 000000 100000
RKDS
100701
MESS      A      B
00      110742    100000
01      101722    000001
10      000002    121102
11      116272    004303-----MESSAGE B3
CURRENT SUPPLIED
CMND  CYL  TRK  SEC  OFFSET  BUS AD  WRD CT
000121 001044 000001 000011 000000 066610 166030
PREVIOUS
CMND  CYL  TRK  SEC  WRD CT
000121 001021 00002 000016 174650
RKECPT RKECPS
002000 000701
ERROR RECOVERY SUCCESSFUL
```

24.3.1.2 VAX Diagnostic EVRAA

From an EVRAA error printout as well as problems determining the correct head number in error there is also misleading information as to the type of error.

The golden rule is to IGNORE the annotations of the RKMR2 and RKMR3 registers, EVRAA will indicate things like R/W unsafe, seek incomplete and other various errors. The real error will be in RKER or RKDS or RKCS2.

As for determining the head in error the annotations of register RKDA will give the track at time of error.

An example ...

**** VAX DISK AND TU58 RELIABILITY TEST ** EVRAA ** - 12.0 ****
pass 1, test 4, subtest 0, error 3, 5-Jan-1987 15:22:19.10
Hard error while testing DMA3:

FUNCTION INITIATION SUMMARY:
FUNCTION ATTEMPTED: READ DATA
BUFFER ADDRESS RANGE: FROM 0004E400 TO 0004F843
ATTEMPTED BYTE COUNT WAS 5188
STARTING DISK ADDRESS:
CYLINDER: 351 TRACK 1 SECTOR: 8

FUNCTION ABORT SUMMARY:

DATA CHECK ERROR

```

RKCS1 : 84D8 ;CERR-CCLR,CDT,RDY,IE,FUNCTION-WRITE CHECK
RKWC : F89E ;WORD COUNT=F89E(X)
RKBA : 0580 ;BUS ADDRESS=0580(X)
RKDA : 010B ;TRACK=1(D),SECTOR=11(D)
RKCS2 : 00C3 ;OR,IR,DRIVE SELECT=3(D)
RKDS : 81C1 ;SVAL,DDT,DRDY,VV,DRA
RKER : 8000 ;DCK-----REAL ERROR
RKASOF : 0000 ;OFFSET=000(D)
RKDC : 015F ;DESIRED CYLINDER=00351
RKMR1 : 2400 ;ECCW,MEND
RKECPS : 0836 ;ECC POSITION=0836(X)
RKECPT : 06B8 ;ECC PATTERN=6B8(X)
RKMR2 : FA80 ;PARITY,DSC,PIP,SPON,WL,FORMAT,DRY,DRV SEL=0(D)
RKMR3 : 5400 ;RWUNS,SPLS,SEEKINC,MESREQ=0(D)-----+
UBADPN : 00000001 ;UBA DATA PATH NUMBER=000000001(D) !
UBADPR : 00000931 ;BS=00(X),BUBA=0931(X) !
UBAFMAP : 802000D1 ;VALID,DP=01(D),PFN=0000D1(X) !
UBAPMAP : 802000D2 ;VALID,DP=01(D),PFN=0000D2(X) !
***** End of Hard error number 3 ***** !

```

IGNORE these errors

24.3.2 RK06/7 Message Lines

RK06/7's communicate with the RK611 controller via two serial message lines known as message lines A and B. Each message line has four status messages A0, A1, A2, A3 and B0, B1, B2, B3 these message lines are a very useful troubleshooting tool.

Looking at the message lines is a much quicker and easier way of looking at all the error conditions in a drive and it saves you carrying your scope up the stairs!! For instance if you go up to a drive with a fault light on you can use the manual method to get the message lines (B0 and B1 are the most useful in a fault light situation) and you can find out exactly what is causing the fault light without even taking the drive covers off. See Figure 24-1 and Figure 24-2 for a breakdown of the message line bits.

Figure 24-1: RK06/RK07 A Message Lines

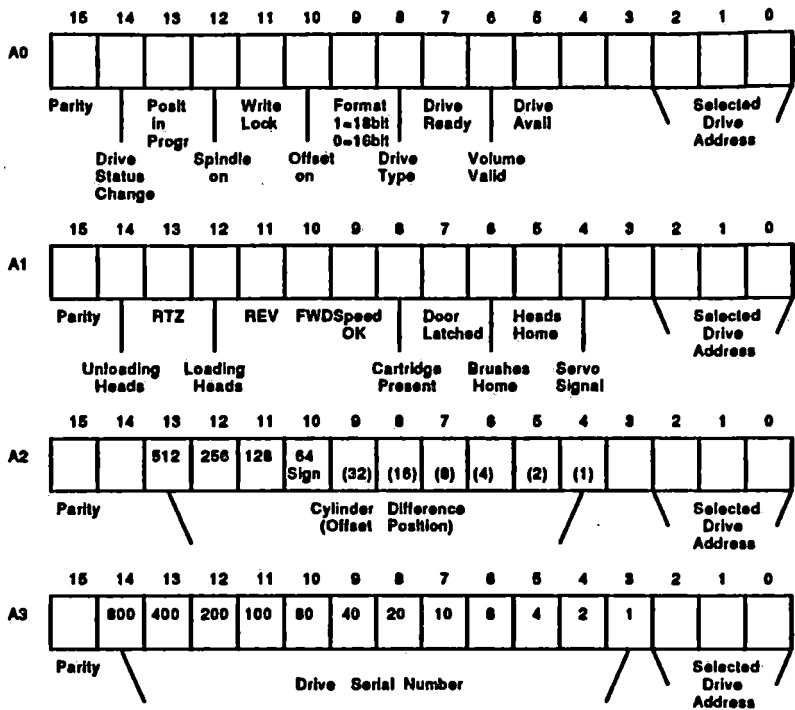
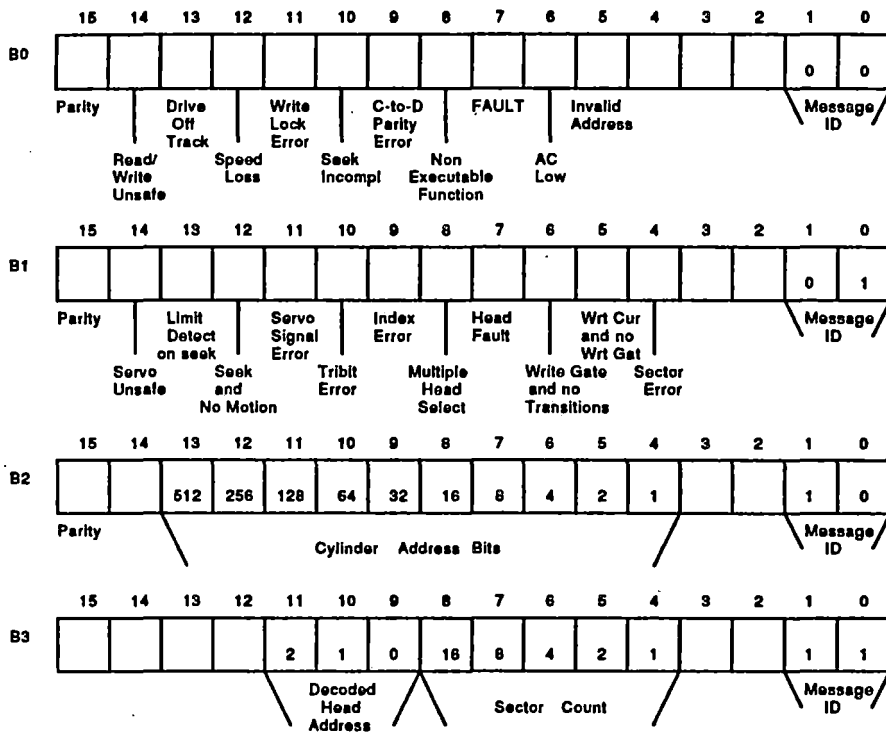


Figure 24-2: RK06/RK07 B Message Lines



The contents of the message lines are available in three ways, firstly from a diagnostic or errorlog printout, secondly by connecting a tester to a drive and finally by manually accessing the RK611 registers. The first two are straight forward but the manual method is as follows ...

DO NOT INIT BUS , (or you loose all the info).

1. Deposit drive number in 177450
2. Deposit message line required in 177468

0	A0/B0
1	A1/B1
2	A2/B2
3	A3/B3
3. Deposit 2001 (0001 for RK06) in 177440 (port light comes on)
4. Now examine 177474 for the selected A message and examine 177476 for the selected B message
5. If you now wish to examine another pair of message lines you must deposit 100000 in 177440 before step 1.

24.3.3 RK07 Runout check

To measure the runout of a RK07 pack/spindle use the following method ...

1. Connect Channel 1 of your scope to Pin B7R2 (Trk err signal)
2. Connect the external trigger to Pin B5R1.
3. The signal should not have an amplitude of greater than 400mV.

24.3.4 Useful part numbers

Some part numbers on RK06/7's can be confusing because there is a difference between early and late model drives. The table below lists both where applicable, where there is only an early model part number then the same part is used on both.

Table 24-2: RK06/RK07 Part Numbers

	RK06		RK07	
	Early Model	Late Model	Early Model	Late Model
Head 0	74-14130-11		70-14411-00	
Heads 1,2	74-14130-12		70-14411-01	
Servo Head	74-14130-13		70-14411-02	
Carriage	70-11915	70-11915-01	70-11915	70-11915-01
Spring way	70-12498		70-12498	
Fixed way	74-14351		74-14351	
Motor	70-12256-01		70-12256-01	

EARLY MODEL DRIVES HAVE A TRANSITION BOARD AT THE BACK OF THE MAGNET.

LATE MODEL DRIVES HAVE NO TRANSITION BOARD AND THE MAGNET IS BLACK.

Table 24-2 (Cont.): RK06/RK07 Part Numbers

	RK06		RK07	
	Early Model	Late Model	Early Model	Late Model
Spindle	12-12948		12-12948	
Belt	12-12635-02		12-12635-02	
Velocity xducer	70-12524	70-12524-01	70-12524	70-12524-01
Battery pack	70-11877	70-14907	70-11877	70-14907
Front latch	70-11912	70-11912-01	70-11912	70-11912-01
Servo preamp	54-11687		54-11687	
Abs filter	12-12904		12-12904	
Speed sensor	70-11918	70-11918-01	70-11918	70-11918-01
Front panel	54-11823		54-11823	
R/W module	54-11060		54-11060-YA	
Cct breaker assembly	70-11632-01	70-14919-01	70-11632-01	70-14919-01
Blower	70-12821		70-12821	
Spindle Gnd std	12-12640		12-12640	

EARLY MODEL DRIVES HAVE A TRANSITION BOARD AT THE BACK OF THE MAGNET

LATE MODEL DRIVES HAVE NO TRANSITION BOARD AND THE MAGNET IS BLACK.

24.3.5 PDP11 Bootstrap noddy

There is not a noddy bootstrap for RK06/7's in the XXDP pocket guide, so use the following . . .

```

Load Address      10000
Deposit           012737
                  002003      (000003 for RK06)
                  177440
                  132737
                  000200
                  177440
                  001774
                  012737
                  002021      (000021 for RK06)
                  177440
                  000001

Load Address 10000 and Start.
Wait 2 Seconds.
Halt.
Load Address 0 and Start.
```

24.3.6 Velocity Adjustment

1. Set drive up doing full length seeks, 0-411 for RK06, 0-815 for RK07
2. Scope pin C5P1 (PIP H on M7705).

3. Adjust signal for a period of 73 milliseconds.

Note

YOU CAN USE XXDP DIAGNOSTIC ZR6M OR VAX DIAGNOSTIC
EVRAA TO GIVE YOU AN APPROXIMATE VERIFICATION, BUT
DO NOT USE ZR6M OR EVRAA TO MAKE THE ADJUSTMENT.

24.3.7 RK06 RK07 RL01 RL02 Dodgy heads

Refurbished heads supplied by DRH of Staines had a quality problem.
Be prepared for multiple DOAs.

24.4 RM02 and RM03 disks

All you need to know is included in the **RM02/03 DISK SUBSYSTEM SERVICE MANUAL**. This is on Fiche as well as hardcopy. It includes DEC numbers for all the parts you are likely to need, FRU replacement procedures, adjustments, and a Fault Isolation Guide.

The **RM03 DISK DRIVE TECHNICAL MANUAL VOL 1** gives a complete IPB.

The RM03 is basically the same as a RM02 but it revolves at a different speed, the motor, heads and a few modules are different between the two. Make sure you use the correct list of parts!!!!

24.5 DISK media cleaning

From Duncan Surridge 12-May-1988.

The **INSPECTION** of all disk media is acceptable, but only glide-testers should be used on RA60a.

CLEANING of RA60 and RM05 media is not acceptable (even off-site).

10. For each setting of the dial-up switches :-

Use the **DISTANCE DIAL** to scan the length (in feet) of your massbus chain.

A mismatch will cause a step in the trace.

A properly terminated line will leave the trace unaffected after the 3' step.

A short-to-ground causes the trace to drop to zero.

An open-circuit causes the trace to rise to double the pulse amplitude.

Note that Pin 39 and 40 on each cable are 'special'

At the terminator :-

Each massbus differential signal (twisted pair, generically called SIG+ and SIG-) go to the two ends of a two-resistor-chain.

The centre points of all the two-resistor-chains are joined to a 'common point'.

Pin 40 and Pin 39 are different :-

The 'common point' is joined (via W2) to Pin 40, Pin 40 is expected to be earthed at the controller end of the massbus cable.

don't know why you would ever want to cut W2.

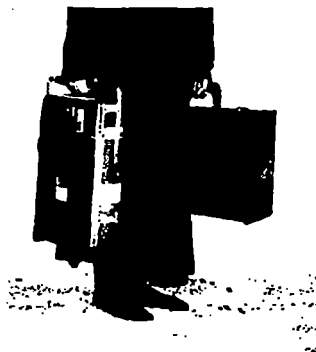
Pin 39 is joined (via W1) to the 'common point', Pin 39 is used on the massbus for the non-differential signals "MASS FAIL" and "RUN".

On Cable A, W1 will be cut, this allows the line to be used for "MASS-FAIL".

On Cable B, W1 is immaterial as Pin 39 is not used.

On Cable C, W1 will be cut, this allows the line to be used for "RUN".

Figure 1 - The two boxes making up the TDR.



24.6 The TDR, Time Domain Reflectometer

The TDR is an instrument to check the integrity of transmission lines. Amongst other things we are particularly interested in its use to checkout massbus runs. It is covered in the VAX Generalist T6 study guide.

The TDR comes as two boxes (see figure 1) :-

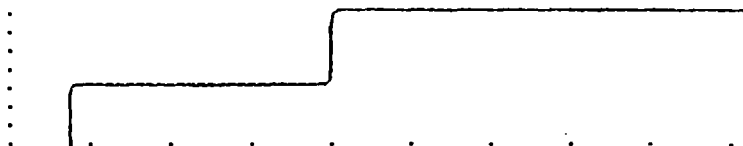
- TE-TDRTE-S1, this is the DEC ADAPTER, which allows each line in a massbus cable run to be switched to the output of the TEK pulse generator / display.
- TE-TDRTE-S2, this is the TEK 1502 TDR which generates the test pulse and displays the effect of the cable run under test.

To use the TDR :-

1. Plug in and Power-On the TEK 1502.
2. Nothing will happen for a few minutes, until BATTERY is O/K (see figure 2).
3. Setup the TEK TDR :-
 - Set mp/division switch to 500.
 - Set feet/division switch to 1 and X1.
 - Set Cable Dielectric switch to OTHER.
 - Set Distance Dial to 000.
4. Adjust ZERO REF and vertical POSITION to display the pulse at the left-hand edge



5. Plug the 3 foot co-ax cable into the TEK TDR CABLE output socket. (see figure 2). The trace should show a step at 0 feet and approximately 3 feet.



6. Plug the other end of the 3 foot co-ax cable into the TDR INPUT socket on the DEC ADAPTER (see figure 2)
7. The display will alter, the clean step at approx 3' will alter to a raggedly rising step.
8. On the DEC ADAPTER, set the four dial-up switches ANTI-CLOCKWISE.
9. Plug the beginning of the cable run to be tested into the DEC ADAPTER (see figure 2).

Figure 2 - The two boxes set up for testing a massbus run, showing :-

- 1 - The TEK BATTERY O/K indicator
- 2 - The TEK TDR cable socket
- 3 - The 3 foot coax cable
- 4 - The massbus socket

